What is claimed is:

1. A system for sequestering carbon dioxide from a gas stream comprising:

a gas stream containing carbon dioxide; and

a first reaction chamber for reacting a metal silicate with a caustic material to produce a hydroxide of the metal, and a second reaction chamber for contacting the metal hydroxide with the gas stream containing the carbon dioxide to produce a carbonate of the metal.

2. A system according to claim 1 wherein the gas stream is a flue gas.

3. A system for carbonating a metal silicate comprising:

(a) a supply of the metal silicate entering the system;

(b) a source of carbon dioxide entering the system;

(c) a reactor structured for converting the metal silicate to a metal carbonate and silica with the use of a caustic material, and with the use of the carbon dioxide; and

(d) the metal carbonate and the silica exiting the system as separate products.

4. A system according to claim 3 wherein the metal silicate is magnesium silicate and the metal carbonate is magnesite.

5. A system according to claim 4 wherein the magnesite has a purity of at least about 90%.

6. A system according to claim 3 wherein the silica has a purity of at least about 90%.

7. A system according to claim 3 wherein the source of carbon dioxide is at least one of alkali-metal carbonate and alkali-metal bicarbonate.

8. A system for recovering a useful metal from rock comprising:

(a) a supply of rock entering the system, the rock containing the useful metal and a metal silicate;

(b) a source of carbon dioxide entering the system;

(c) a reactor structured for converting the metal silicate to a metal carbonate, with the use of a caustic material, and with the use of the carbon dioxide;

(d) apparatus for removing the useful metal from the rock;

(e) a stream of the metal carbonate exiting the system; and

(f) a stream of the useful metal exiting the system.

9. A system according to claim 8 wherein the rock is serpentine and the useful metal is magnetite.

10. A system according to claim 8 wherein the apparatus for removing the useful metal from the rock is located prior to the reactor.

11. A system according to claim 8 wherein the apparatus for removing the useful metal from the rock is located subsequent to the reactor.

12. A process of carbonating a metal silicate comprising the steps of:

(a) reacting the metal silicate with a caustic material to produce a hydroxide of the metal;

(b) reacting the metal hydroxide with a source of carbon dioxide to produce a carbonate of the metal and to produce reconstituted caustic material; and

(c) introducing the caustic material from step (b) into step (a).

13. A process according to claim 12 wherein most of the caustic material of step (a) comes from step (b).

14. A process of carbonating a metal silicate comprising:

reacting at least the metal silicate and a source of carbon dioxide to produce a carbonate of the metal;

wherein the reaction is conducted at a pressure not greater than about 50 bars above the vapor pressure of pure water for the temperature of the reaction.

15. A process according to claim 14 wherein the reaction is conducted at a pressure not greater than about 30 bars above the vapor pressure of pure water for the temperature of the reaction.

16. A process of sequestering carbon dioxide comprising the steps of:

(a) reacting a metal silicate with a caustic alkali-metal hydroxide to produce a hydroxide of the metal formerly contained in the silicate;

(b) reacting carbon dioxide with at least one of a caustic alkali-metal hydroxide and an alkali-metal silicate to produce at least one of an alkali-metal carbonate and an alkali-metal bicarbonate; and

(c) reacting the metal hydroxide product of step (a) with at least one of the alkali-metal carbonate and the alkali-metal bicarbonate produced in step (b) to produce a carbonate of the metal formerly contained in the metal silicate of step (a).

17. A process according to claim 16 wherein the reaction of step (c) also produces a caustic alkali-metal hydroxide, and wherein the process comprises an additional step (d) of recycling the caustic alkali-metal hydroxide from step (c) into the reaction of step (a).

18. A process according to claim 16 wherein steps (b) and (c) are conducted at a pressure not greater than about 50 bars above the vapor pressure of pure water for the temperature of these two steps.

19. A process according to claim 16 wherein the metal silicate is magnesium silicate, and wherein at least one of step (a) and step (b) also produces silica.

20. A process according to claim 16 wherein the metal silicate is magnesium silicate, and wherein the process produces at least one of magnesite and eitelite.

21. A process according to claim 16 wherein the metal silicate is a calcium silicate, and wherein the process produces calcite.

22. A process according to claim 16 wherein the metal silicate is an iron-bearing silicate, and wherein the process produces siderite.

23. A process according to claim 16 wherein the metal silicate is selected from the group consisting of calcium silcates, magnesium silicates, iron-bearing silicates, and mixtures thereof, in either the crystalline or amorphous state.

24. A process according to claim 16 comprising an additional step, before step (a), of reducing the particle size of the metal silicate to an average diameter of less than about two millimeters.

25. A process according to claim 16 wherein the caustic alkali-metal hydroxide of step (a) is an aqueous solution comprising from about 10% to about 90% alkali-metal hydroxide and from about 10% to about 90% water, by weight.

26. A process according to claim 16 wherein the caustic alkali-metal hydroxide of step (a) is selected from the group consisting of sodium hydroxide, potassium hydroxide, lithium hydroxide, and mixtures thereof.

27. A process according to claim 16 wherein the process is conducted without heat pretreatment of the metal silicate feedstock.

28. A process of carbonating a metal silicate comprising the steps of:

(a) reacting the metal silicate with a caustic alkali-metal hydroxide to produce a hydroxide of the metal formerly contained in the silicate; and

(b) reacting the metal hydroxide with a source of carbon dioxide to produce a carbonate of the metal formerly contained in the metal silicate of step (a).

29. A process according to claim 28 wherein the reaction of step (b) also produces a caustic alkali-metal hydroxide, and wherein the process comprises an additional step (c) of introducing the caustic material from step (c) into step (a).

30. A process according to claim 28 wherein step (b) is conducted at a pressure not greater than about 50 bars above the vapor pressure of pure water for the temperature of step (b).

31. A process of producing a metal carbonate comprising reacting an alkaline-earth metal hydroxide with at least one of an alkali-metal carbonate, an alkali-metal bicarbonate, and carbon dioxide, to produce a carbonate of the metal formerly contained in the metal hydroxide.